

Lightweight Metal Rubber™ Sensors and Interconnects, Phase I

Completed Technology Project (2006 - 2006)



Project Introduction

The objective of the proposed program is to develop lightweight and highly elastic electrically conducting interconnects and strain sensor arrays for next generation adaptive aerospace vehicles and structures. The systems-level problem this would solve is the inability of currently available materials to undergo the large strains and displacements associated with shape changes of morphing structures. NanoSonic will demonstrate the feasibility of the Metal Rubber™ family of freestanding nanocomposite materials to serve as 1) electrically conductive, low modulus electrodes for large displacement mechanical actuators required to affect large shape changes, and 2) an integrated network of strain sensors to allow mapping of strain and determination of shape in adaptive structural components. Metal Rubber

™

is fabricated via layer-by-layer, molecular self-assembly, which enables thickness and placement control over multiple molecular constituents for true nanostructured multifunctionality. As an electrode material, new, ultra-low modulus Metal Rubber

™

can be strained to 1000% elongation while remaining electrically conductive; it returns to its original shape and nominal conductivity when released. As a strain sensor, strains up to 1000% have been measured in very highly flexible structures. During Phase I the feasibility of using such electrodes and strain sensors would be demonstrated in cooperation with a large aerospace company.

Anticipated Benefits

Potential NASA Commercial Applications: Metal Rubber

™

can be used as replacements for conventional tin-lead solder for the mechanical, electrical and thermal interconnection of electronic and mechanical components. Similar materials may also be used in high performance, highly flexible and mechanically robust electronic flex circuits, flexible displays and smart electronic fabrics.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

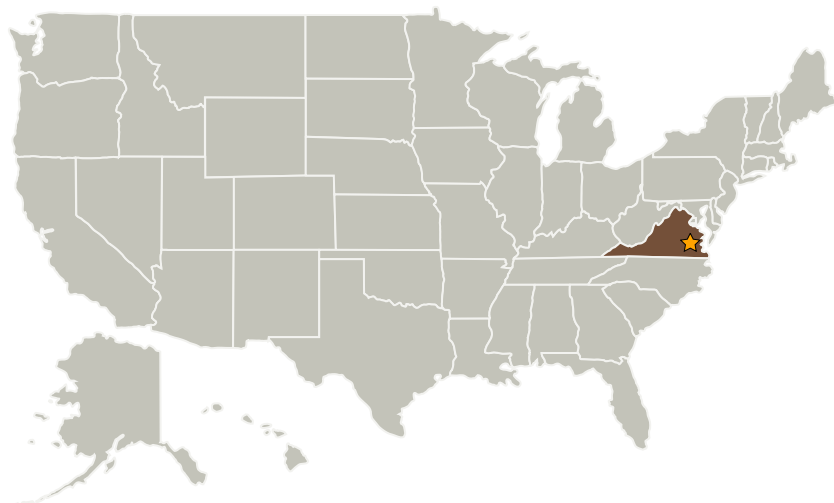
Small Business Innovation Research/Small Business Tech Transfer

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Langley Research Center (LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Nanosonic, Inc.	Supporting Organization	Industry	Pembroke, Virginia

Primary U.S. Work Locations

Virginia

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Andrea J Hill

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.1 Materials
 - └ TX12.1.8 Smart Materials